PennState College of Engineering | BIOMEDICAL ENGINEERING

Seminar Series

Dr. Sarah C. Heilshorn

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Stanford University

Bespoke Biomaterials: Towards Personalized Tissue Mimics

October 7 • 12:05–1:20 p.m.

ABSTRACT

Each individual is unique, yet pharmaceutical companies design the same therapies for all of us using lab mice. In the future, the biofabrication of personalized tissue mimics offers the exciting possibility of individualized therapies. However, current biofabrication methods are greatly hampered by a lack of materials that are simultaneously biofunctional and reproducible. A cell's behavior is directly influenced by its surrounding microenvironment; thus, ideally each cell type would be cultured in its own customizable biomaterial. To fulfill this need, Dr. Heilshorn's lab designs bespoke biomaterials that can be tailored to fit a range of applications. In one demonstration, she presents a family of biomaterials that support the growth of patient-derived organoids (i.e., three-dimensional cell aggregates that demonstrate emergent, tissue-like behavior). While organoid cultures have the potential to revolutionize our understanding of human biology, current protocols rely on the use of Matrigel, a complex, heterogeneous material with large batch-to-batch variations. In contrast, Dr. Heilshorn's double-network hydrogels are formulated with recombinant biopolymers that can be fine-tuned to display a reproducible range of biochemical and biomechanical properties. In a second example, she presents a new family of bioinks that enable cell-based 3D bioprinting. Dr. Heilshorn and her lab named this family of materials UNIversal, Orthogonal Network (UNION) bioinks, because they utilize a versatile crosslinking mechanism that is cell compatible and works to form a cohesive interface between disparate biopolymers. They envision that these two technologies will be used together in the future to create personalized tissue models of individual patients.

BIO

Dr. Sarah C. Heilshorn is a professor and associate chair in the Department of Materials Science and Engineering at Stanford University. Her laboratory integrates concepts from materials science and protein engineering to design bioinspired materials for regenerative medicine, organoid culture, and bioprinting. She is a fervent supporter of diversifying the research community. She is a fellow of the American Institute for Medical and Biological Engineering and the Royal Society of Chemistry. She serves as associate editor of the journal *Science Advances*, as special content editor of *Acta Biomaterialia*, and on the board of directors for the Materials Research Society and the International Society for Biofabrication.

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